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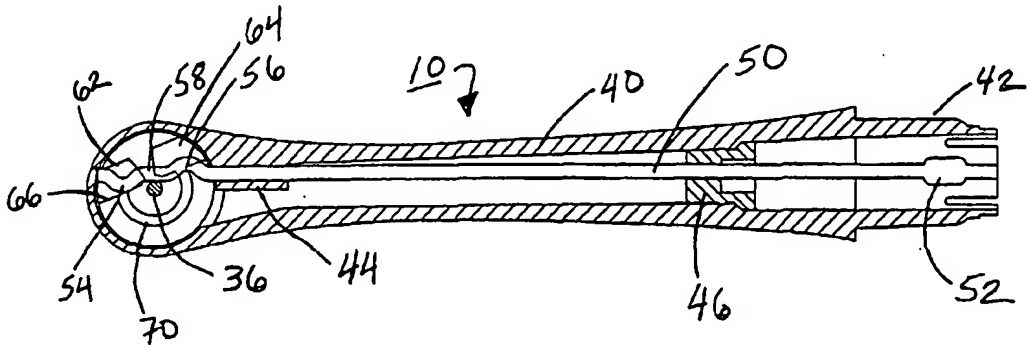
(54) Title: OSCILLATORY HEAD ATTACHMENT FOR AN ELECTRIC TOOTHBRUSH



(57) Abstract: An oscillatory head attachment for an electric toothbrush has a circular bristle head with front and back sides. An axial spindle is on the back side. There is an elongate hollow body with a longitudinal axis, and the bristle head is mounted such that the spindle axis intersects the longitudinal axis of the body. A rotatable drive shaft extends through hollow body from and is rotatably supported by a first bearing near located adjacent the bristle head. The drive shaft has a longitudinal axis, and first and second crank lobes at the outer end so as to constitute a two-lobe crank shaft, with the crank lobes spaced lengthwise and disposed 180° from each other. A pair of depressions is formed on the back side, one at each side of the spindle; and each has a vertical cam surface located in a plane which defines a chord of the circular bristle head, and which extends from the back side of the bristle head in a direction parallel to the spindle axis. The crank lobes are adapted to overlie the pair of depressions in a manner such that they will alternately engage a respective one of the vertical cam surfaces so as to cause an oscillatory rotary movement of the bristle head about the spindle axis.

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OSCILLATORY HEAD ATTACHMENT FOR AN ELECTRIC TOOTHBRUSH

FIELD OF THE INVENTION:

[0001] This invention relates to electric toothbrushes, and particularly to electric toothbrushes that have a circular bristle head that moves with an oscillatory rotary action. The present invention is specifically directed to an oscillatory head attachment for electric toothbrushes, where the head attachment derives the oscillatory rotary movement of the bristle head by a direct drive coupling between a rotating output socket of a power handle for electric toothbrush and the circular bristle head.

BACKGROUND OF THE INVENTION / DESCRIPTION OF THE PRIOR ART:

[0002] Electric toothbrushes having circular bristle heads that have an oscillatory rotary movement are well known. A number of advantages are derived by using electric toothbrushes, including typically an assurance that a more effective cleaning action of the teeth will be effected by the user than would be the case with a manual toothbrush.

[0003] Other advantages typically ascribed to power toothbrushes include the fact that a continuous sweeping action by the toothbrush bristles against the teeth and at the gum line, can be more easily attained. However, this requires that there be at least some reasonable motion lengthwise or in a rotary fashion for such power toothbrushes that are designed so that the ends of the bristles are in continuous contact with the teeth, because otherwise an oscillatory motion which is too small might result simply in a wave motion occurring within the length of the toothbrush bristles while the end of the bristles remain substantially in the same place in contact with the tooth. This effect may occur especially in toothbrushes that have a small oscillatory movement, and where too much pressure is directed at the tooth along the length of the toothbrush bristles by the user of the toothbrush.

[0004] One solution for those problems is particularly to provide toothbrushes that provide rotary bristle heads – that is, circular bristle heads that move with an oscillatory rotary movement. The oscillatory movement is particularly effective because it causes a whipping or scrubbing action of the ends of the toothbrush bristles against the surfaces of the teeth; and the rotary oscillatory

movement has been found to be particularly effective because the bristles move at different speeds depending on their position away from the centre of the circular bristle head, in a radial direction.

[0005] However, it is also believed that more effective cleaning action will occur when there are no profound discontinuities in the placement of the toothbrush bristle bundles in the concentric circles in which they are arranged on the circular bristle head.

[0006] That disadvantage occurs particularly in a toothbrush which is taught in McDOUGALL United States patent No. 5,625,916 issued May 6, 1997. As it happens, toothbrushes which embody a head design which is effectively as that which is taught in the McDougall patent are found widely in the market, as they are brought to the market by a major manufacturer of toothbrushes, toothpaste, other dentifrices, and other oral hygiene products.

[0007] The McDougall toothbrush head provides a direct drive from the rotary source of driving power to the bristle head, without the necessity for intervening drive links or gear arrangements. Effectively, a simple crank is provided at the end of a shaft, where the crank rotates and drives a circular bristle head in a rotary oscillatory movement by its interference within a slot formed in the periphery of the bristle head.

[0008] However, in order to obtain a greater amount of rotation, it is necessary for the interruption in the placement of the toothbrush bristle bundles to be wider.

[0009] Although the McDougall patent describes the rotary movement as being in the range of 10° to 50°, with a preferable rotary movement of 30°, commercial versions of the toothbrush were found to have a rotary movement of 24°.

[0010] The present inventor has unexpectedly determined that a direct drive to a circular bristle head may be effected without any intervening drive links or gear arrangements of any sort, and without affecting the bristle bundle placement on the front face of the bristle head, by effectively providing a crank shaft which has lobes that drive against cam surfaces formed on the back surface of the circular bristle head.

[0011] By being able to move the axis of rotation of the crank shaft quite close to the axis of rotation of the circular bristle head, a reasonable oscillatory rotary movement of the bristle head may be achieved without the necessity to provide crank shafts that have a long throw.

[0012] This presents several other advantages, as well. They include the fact that a very robust direct drive system can be produced at very low cost, because it has few moving parts, and because it is only necessary for the robustness of the drive train for the circular bristle head of an oscillatory head attachment for electric toothbrushes to be such as to outlast the life of the toothbrush bristle bundles themselves. Once the bristle bundles have worn out, the oscillatory head attachment is disposed of, and a new oscillatory head attachment is placed on the power handle.

[0013] Moreover, the arrangement of the oscillatory head attachment for electric toothbrushes, as provided by the present invention, is such that an even distribution and reasonable packing density of packing toothbrush bristle bundles may be achieved in their placement on the circular bristle head. As noted above, more effective scrubbing action by the ends of the toothbrush bristles against the teeth is thereby achieved.

SUMMARY OF THE INVENTION:

[0014] In accordance with one aspect of the present invention, there is provided an oscillatory head attachment having a power handle with a rotating output connector, where the oscillatory head attachment comprises a circular bristle head, an elongate hollow body, and a rotatable drive shaft extending through the elongate hollow body.

[0015] The circular bristle head has a front side from which a plurality of toothbrush bristle bundles are upstanding, and a back side having an upwardly directed spindle upstanding therefrom.

[0016] The elongate hollow body has a longitudinal axis, with the circular bristle head being mounted at a first end of the body such that the axis of the spindle generally intersects the longitudinal axis of the elongate hollow body.

[0017] The body is adapted at a second end remote from the first end to be connected to a mating power handle for an electric toothbrush.

[0018] A rotatable drive shaft extends through the elongate hollow body from the second end to the first end, and is rotatably supported within the hollow body by at least a first bearing near a first end of the drive shaft. The first bearing is located within the elongate hollow body at a location which is adjacent the bristle head.

[0019] The rotatable drive shaft is adapted at a second end thereof which is remote from the first end to be rotatably coupled to a rotating output connector of a power handle.

[0020] The drive shaft has a longitudinal axis, and it has first and second crank lobes which are arranged at the first end of the drive shaft so as to constitute a two-lobe crank shaft. The first and second crank lobes are spaced along the crank shaft at the first end of the drive shaft, and are disposed 180° from each other. There is an intermediate shaft portion between the first and second lobes; and the intermediate shaft portion is located along the longitudinal axis of the drive shaft.

[0021] The backside of the bristle head has a pair of depressions which are formed therein, one at each side of the spindle.

[0022] The depressions each have a vertical cam surface which is located in a plane that defines a chord of the circular bristle head. The plane which defines the vertical cam surfaces of the depressions extends across the bristle head in a direction that is parallel to the spindle axis.

[0023] The first and second crank lobes are adapted to overlie the pair of depressions in a manner such that they will alternately engage a respective one of the vertical cam surfaces, so as to cause an oscillatory rotary movement of the bristle head about the spindle axis.

[0024] So as to gain as much mechanical advantage as possible, it is typical that the intermediate portion of the two-lobe crank shaft lies adjacent the spindle on the circular bristle head. Indeed, it is common that the distance between the spindle axis and the longitudinal axis of the drive shaft is less than the twice the combined diameters of the spindle and the intermediate shaft portion.

[0025] In keeping with another provision of the present invention, a second bearing may be provided for rotatably supporting the drive shaft, at a location near the second end of the elongate body.

[0026] A particular provision of the present invention is that each of the depressions that are formed on the back side of the bristle head has an upwardly sloping bottom surface which extends upwardly and away from the bottom end of the respective vertical cam surface.

[0027] Further, the present invention provides that the plurality of toothbrush bristle bundles that are upstanding from the front side of the circular bristle head are arranged on that front side in at least concentric circles of bristle bundles, with the centre thereof being the spindle axis.

[0028] Typically, the bristle bundles are evenly spaced from each adjacent bristle bundle in each of the concentric circles.

[0029] The present invention provides that, typically, the extent of the oscillatory rotary movement of the bristle head about the spindle axis is in the range of 15° to 45°.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0030] The novel features which are believed to be characteristic of the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following drawings in which a presently preferred embodiment of the invention will now be illustrated by way of example. It is expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention. Embodiments of this invention will now be described by way of example in association with the accompanying drawings in which:

[0031] **Figure 1** is a side elevation of an oscillatory head attachment for an electric toothbrush, in keeping with the present invention;

[0032] **Figure 2** is a plan view of the oscillatory head attachment of Figure 1, looking from the bottom thereof;

[0033] **Figure 3** is a view similar to Figure 2, but showing an assembled electric toothbrush having the oscillatory head attachment of the present invention secured to a power handle therefor;

[0034] **Figure 4A** is a section view looking in the direction of arrows 4 - 4 of Figure 1, when the drive shaft has a assumed a first rotational orientation;

[0035] **Figure 4B** is a view similar to Figure 4A, but where the drive shaft has rotated 90° from the position shown in Figure 4A;

[0036] **Figure 4C** is a view similar to Figure 4A, but where the drive shaft has rotated 180° from the position shown in Figure 4A;

[0037] **Figure 5** is a plan view of the drive shaft and the circular bristle head only of a toothbrush in keeping with the present invention, where the drive shaft has assumed the rotational orientation of that shown in Figure 4B;

[0038] **Figure 6** is a side elevation of the assembly of Figure 5, when the assembly has been rotated 90° out of the plane of the page from its position in Figure 5; and

[0039] **Figure 7** is a perspective view to a much larger scale of the circular bristle head configuration of an oscillatory head attachment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

[0040] The novel features which are believed to be characteristic of the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following discussion.

[0041] For purposes of illustration, Figure 3 shows an oscillatory head attachment for an electric toothbrush, which is attached to a power handle so as to provide the full assembly. The remaining figures show either the oscillatory head attachment *per se*, features thereof, details thereof, and elements thereof.

[0042] An oscillatory head attachment is shown generally at 10 in Figures 1 through 4C; and, as seen in Figure 3, the oscillatory head attachment is fitted through a power handle 12 so that the user has an electrically powered toothbrush.

[0043] Within the power handle 12, there may typically be a pair of batteries 14, which provide the driving energy for a small electric motor 16. The electric motor 16 has a drive output 18, from which rotating drive power is delivered to the oscillatory head attachment of the present invention, in the manner described hereafter. Those internal features of the power handle 12 are shown in ghosted outline.

[0044] So as to start and stop the operation of the electric toothbrush assembly shown in Figure 3, a start switch 20 and a stop switch 22 are provided.

[0045] Typically, the output shaft 18 of the electric motor 16 is fitted with a rotating output connector, to which the drive shaft to be described hereafter is rotatably coupled. All of those details are outside the scope of the present invention.

[0046] The principal components of the oscillatory head attachment for an electric toothbrush in keeping with the present invention are a circular bristle head 30, an elongate hollow body 40, and a rotatable drive shaft 50.

[0047] The circular bristle head 30 has a front side from which a plurality of toothbrush bristle bundles 32 are upstanding, as seen particularly in Figures 1 and 7. The circular bristle head 30 also has a back side indicated generally at 34 in Figure 7, and there is an axially directed spindle 36 which is upstanding from the back side 34.

[0048] As can be seen particularly in Figures 4A, 4B, and 4C, the body 40 is hollow. It will be understood that the elongate hollow body 40 has a longitudinal axis which extends throughout its length. It will be seen that the circular bristle head 30 is mounted at a first end of the body 40, as seen particularly in Figures 1 through 3.

[0049] It will also be understood that the spindle 36 has a spindle axis; and it will be clearly understood from Figures 1 through 3, 4A, 4B, and 4C, that the axis of the spindle 36 generally intersects the longitudinal axis of the hollow body 40. There may be a slight offset of one axis to the other.

[0050] Obviously, the elongate body 40 is adapted at its second end 42, which is remote from the first end where the circular bristle head 30 is located, to be connected to the mating power handle 12, as indicated in Figure 3.

[0051] The drive shaft 50 is rotatable, and it extends through the length of the hollow body 40 from the second end 42 to the first end. The rotatable drive shaft 50 is rotatably supported within the hollow body 40 by a first bearing 44 which is near the first end of the drive shaft 50, adjacent the bristle head 30.

[0052] It will now be seen that the rotatable drive shaft 50 is not disposed along the longitudinal axis of the elongate hollow body 40, but rather that it is offset from the longitudinal axis of the elongate hollow body 40, particularly at the first, outer end where it interacts with the circular bristle head in the manner to be described hereafter.

[0053] The rotatable drive shaft 50 is adapted at its second end remote from the first end by such as a spade fitting 52, so as to be rotatably coupled to a rotating output connector of the power handle, which is generally but not necessarily a socket, and which is driven by the output shaft 18 of the electric motor 16.

[0054] It will also be understood that the rotatable drive shaft 50 has a longitudinal axis; and, as described above, the longitudinal axis of the rotatable drive shaft 50 is offset from the longitudinal

axis of the elongate hollow body 40, and is effectively tilted or angled thereto so that the longitudinal axis of the rotatable drive shaft 50 and the longitudinal axis of the elongate hollow body 40 can be considered to intersect in the vicinity of the end of the rotatable drive shaft 50 which couples to a rotating output connector within the power handle 12.

[0055] Referring particularly to Figures 4A, 4B, 4C, and Figures 5 and 6, it will be seen that the rotatable drive shaft 50 has first and second crank lobes 54 and 56 which are arranged at the first, outer end of the rotatable drive shaft 50 in such a manner as to constitute a two-lobe crank shaft. It will be clearly understood from those figures that the first and second crank lobes are spaced along the crank shaft, and are disposed 180° from each other.

[0056] An intermediate shaft portion 58 is located between the first and second lobes 54 and 56; and it will be understood that the intermediate shaft portion 58 is located on the longitudinal axis of the drive shaft 50. Thus, as the drive shaft 50 rotates, the intermediate shaft portion 58 rotates on the same longitudinal axis thereof; and the crank lobes 54 and 56 thereby function as a two-lobe crank shaft with a crank throw being that which is defined by the configuration of the crank lobes 54 and 56.

[0057] It will also be noted that the first bearing 44 assures that the rotatable drive shaft 50 is held in place while it rotates, so that the two-lobe crank shaft comprising crank lobes 54 and 56 will function in their intended manner, as now described.

[0058] The back side 34 of the circular bristle head 30 has a pair of depressions 62 and 64 formed therein. It will be seen in each of Figures 4A, 4B, 4C, 5 and 7 that the depressions 62 and 64 are formed with one being at each side of the spindle 36.

[0059] The depressions 62 and 64 each have a vertical cam surface 66 and 68, respectively. The vertical cam surfaces 66, 68 are located in a plane which defines a chord on the circular bristle head 30, across the back side 34 thereof. Also, the plane in which the vertical cam surfaces 66 and 68 are located extends from the back side of the bristle head 30 in a direction which is parallel to the axis of the spindle 36.

[0060] As seen in Figures 4 through 6, and as will be understood from Figure 7, the first and second crank lobes 54, 56 are adapted to overlie the pair of depressions 62, 64 in such a manner that the crank lobes 54 and 56 will alternately engage the respective vertical cam surface 66 or 68 as the

rotatable drive shaft 50 is rotatably driven, so as to cause an oscillatory rotary movement of the bristle head 30 about the spindle axis.

[0061] Referring to Figure 4A, the rotatable drive shaft has assumed a first position where each of the crank lobes 54 and 56 is essentially in the plane of the page. It will also be seen that the crank lobe 54 is in engagement with the vertical cam surface 66.

[0062] Then, as the rotatable drive shaft 50 rotates – in this case, in a clockwise direction as seen from the right end of the crank shaft 50 – the crank lobe 56 will engage the vertical cam surface 68. After 90° of rotation in a clockwise direction as seen from the right, the drive shaft 50 will have assumed the orientation as seen in Figure 4B; and it will be seen that the interaction between the crank lobe 56 and the vertical cam surface 68 is such that the circular bristle head has rotated in a clockwise manner as seen in Figure 4B, from the position that it had previously assumed as seen in Figure 4A.

[0063] As the rotatable drive shaft 50 is driven yet another 90° in a clockwise direction as seen from the right end, it will then assume the orientation as seen in Figure 4C. At that time, it will be seen that the crank lobe 56 will have driven the circular bristle head 30 further clockwise to assume the position shown in Figure 4C, due to the interaction between the crank lobe 56 and the cam surface 68.

[0064] As the rotatable drive shaft 50 is again driven a further 90°, it will assume an orientation which is 180° rotated to that as seen in Figure 4B; and it will be seen that the rotatable drive shaft 50 and the circular bristle head 30 are once again on their way towards re-assuming the orientation as seen in Figure 4A.

[0065] A ridge may be formed also on the back side 34 of the circular bristle head 30, and its purpose is to extend the height of the cam surfaces 66 and 68 without adding additional mass to the body portion of the circular bristle head 30.

[0066] It will be seen in Figures 4A, 4B, 4C, and 5, that the intermediate portion 58 of the two-lobe crank shaft 54, 58, 56, lies adjacent to the spindle 36 of the circular bristle head 30. However, care is taken that there is no physical interference of the intermediate portion 58 with the spindle 36, in such a manner that driving energy intended to be delivered from the drive shaft 50 to the cam surfaces 66, 68 is lost.

[0067] It will also be understood, of course, that the closer the axis of the rotatable drive shaft 50 is to the axis of the spindle 36, then there will be a greater oscillatory rotation travel for the same height of the crank lobes 54 and 56 than if the longitudinal axis of the rotatable drive shaft 50 were further away from the axis of the spindle 36.

[0068] Typically, the distance between the spindle axis and the longitudinal axis of the rotatable drive shaft 50 is less than twice the combined diameters of the spindle 36 and the intermediate shaft portion 58.

[0069] A second bearing 46 may alternatively also be placed within the elongate hollow body 40, for further rotatable support for the rotatable drive shaft 50.

[0070] Referring particularly to Figure 7, it will be seen that each of the depressions 62 and 64 has an upwardly sloping bottom surface 72 and 74, respectively. The upwardly sloping bottom surfaces 72, 74 extend upwardly and away from the bottom ends of the respective vertical cam surfaces 66 and 68. This provides room for the crank lobes 54 and 56 to move when they are in their non-driving relationship to the respective cam surfaces 66 and 68.

[0071] It will be seen in Figures 2 and 3 that the plurality of toothbrush bristle bundles 32 may be arranged on the front side of the circular bristle head 30 in at least two concentric circles of bristle bundles, with the centre of the those concentric circles being the spindle axis.

[0072] It will also be understood from Figures 2 and 3 that the bristle bundles 32 may be evenly spaced from each adjacent bristle bundle in each of the concentric circles in which they are arranged. Thus, there are no gaps between bristle bundles as are necessary in toothbrushes made in keeping with the 5,625,916 patent, noted above.

[0073] The placement of the two-lobe crank shaft at the end of the rotatable drive shaft 50, and the dimensioning of the first and second crank lobes 54 and 56, may be dimensioned so that the oscillatory rotary movement of the bristle head 30 about the spindle axis is in the range of 15° to 45°. A typical oscillatory rotary movement may be 25° or 30°.

[0074] Typically, the output of the electric motor 16 is in the range of 2,500 to 6,500 RPM. Because the configuration of the present invention provides a direct drive from the electric motor to the circular bristle head 30, the number of oscillatory cycles that the circular bristle head 30 undergoes while it is being driven will be the same as the rotational speed of the drive shaft 50.

[0075] An electric toothbrush has been illustrated, and the oscillatory head attachment for that electric toothbrush has been explained. The structure is such that there is a direct drive which is provided for the circular bristle head, without the necessity for any intervening drive links or gear arrangements, thereby providing greater power efficiency with less loss of driving energy, as well as greater economy in production and thereby lower costs to the consumer.

[0076] Effective toothbrush cleaning action is assured by the structure of the oscillatory head attachment in keeping with the present invention, because there is a sufficient range of oscillatory motion and because there is even an effective toothbrush bristle placement.

WHAT IS CLAIMED IS:

1. An oscillatory head attachment (10) for an electric toothbrush having a power handle (12) with a rotating output connector, said oscillatory head attachment being c h a r a c t e r i z e d by:

a circular bristle head (30) having a front side from which a plurality of toothbrush bristle bundles (32) are upstanding, and a back side (34) having an axially directed spindle (36) upstanding therefrom;

an elongate hollow body (40) having a longitudinal axis, with the circular bristle head being mounted at a first end of the body such that the axis of said spindle generally intersects said longitudinal axis of said elongate hollow body;

said body being adapted at a second end (42) remote from said first end to be connected to a mating power handle for an electric toothbrush;

a rotatable drive shaft (50) extending through said elongate hollow body from said second end to said first end, and being rotatably supported within said hollow body by a first bearing (44) near a first end thereof, said first bearing being located within said elongate hollow body at a location adjacent said bristle head;

said rotatable drive shaft being adapted at a second end thereof remote from said first end to be rotatably coupled to a rotating output connector of a power handle;

said drive shaft having a longitudinal axis, and having first (54) and second (56) crank lobes arranged at said first end thereof so as to constitute a two-lobe crank shaft, where the first and second crank lobes are spaced lengthwise along said crank shaft and are disposed 180° from each other, and with an intermediate shaft portion (58) between said first and second lobes;

said intermediate shaft portion being located on the longitudinal axis of said drive shaft;

said back side of said bristle head having a pair of depressions (62, 64) formed therein, one at each side of said spindle;

said depressions each having a vertical cam surface (66, 68) located in a plane which defines a chord of said circular bristle head, and which extends from the back side of said bristle head in a direction parallel to said spindle axis;

wherein said first and second crank lobes are adapted to overlie said pair of depressions in a manner such that they will alternately engage a respective one of said vertical cam surfaces so as to cause an oscillatory rotary movement of said bristle head about said spindle axis.

2. The oscillatory head attachment of claim 1, wherein said intermediate portion of said two-lobe crank shaft lies adjacent said spindle.

3. The oscillatory head attachment of claim 1, wherein the distance between the spindle axis and the longitudinal axis of said drive shaft is less than twice the combined diameters of said spindle and said intermediate shaft portion.

4. The oscillatory head attachment of claim 1, 2, or 3,further comprising a second bearing (46) for rotatably supporting said drive shaft at a location near said second end of said hollow elongate body.

5. The oscillatory head attachment of claim 1, 2, or 3, wherein each of said depressions has an upwardly sloping bottom surface (72, 74) extending upwardly and away from the bottom end of the respective vertical cam surface.

6. The oscillatory head attachment of claim 1, 2, or 3, wherein said plurality of toothbrush bristle bundles are arranged on said front side of said circular bristle head in at least two concentric circles of bristle bundles, with the centre thereof being said spindle axis.

7. The oscillatory head attachment of claim 10, wherein said bristle bundles are evenly spaced from each adjacent bristle bundle in each of said concentric circles.

8. The oscillatory head attachment of claim 1, 2, or 3, wherein the extent of said oscillatory rotary movement of said bristle head about said spindle axis is in the range of 15° to 45°.

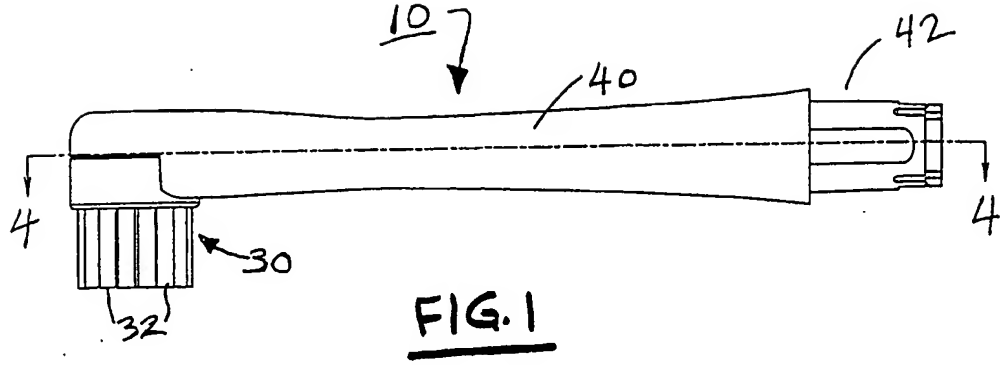

FIG. 1

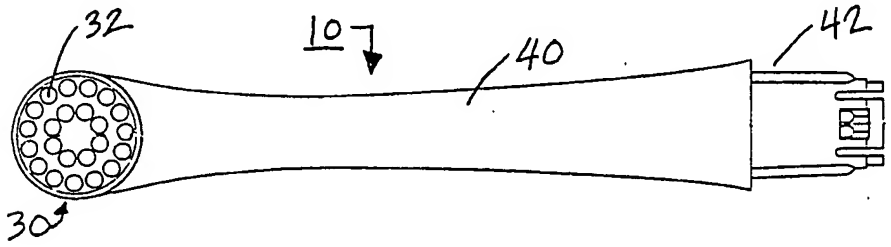

FIG. 2

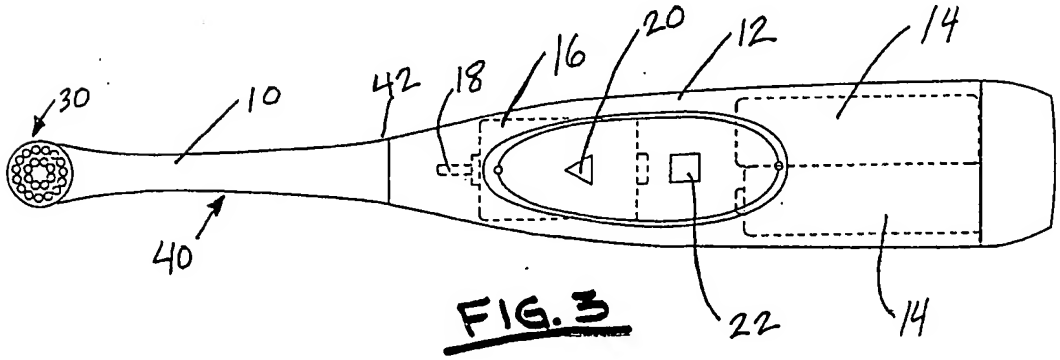

FIG. 3

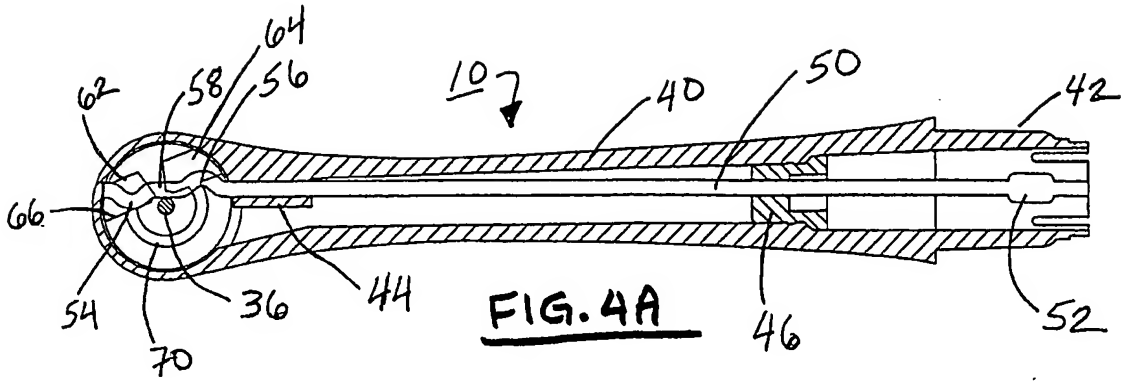

FIG. 4A

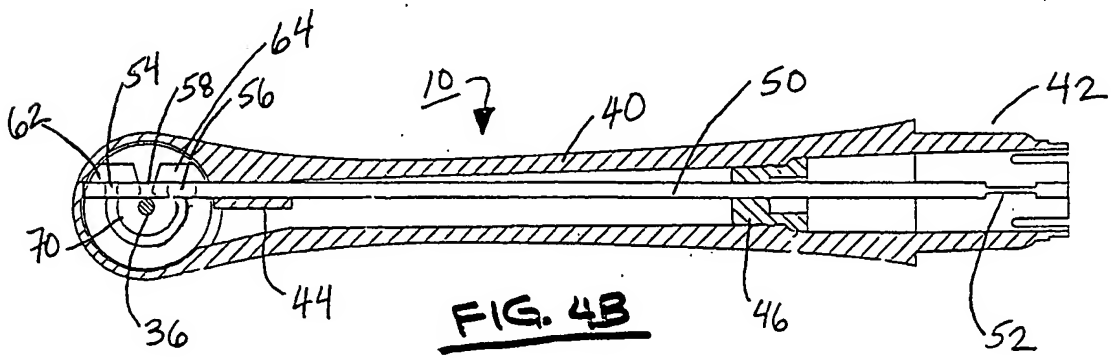

FIG. 4B

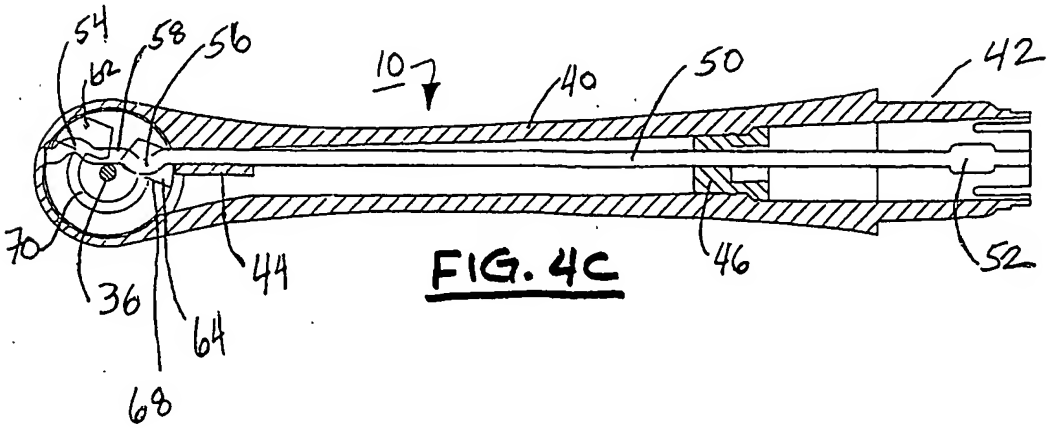

FIG. 4C

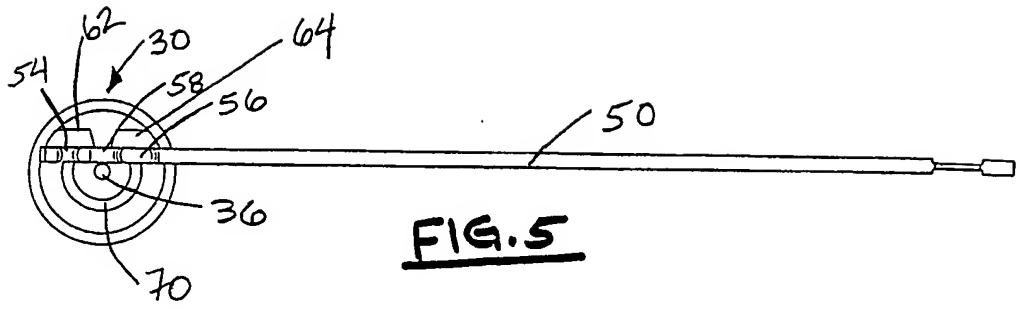

FIG.5

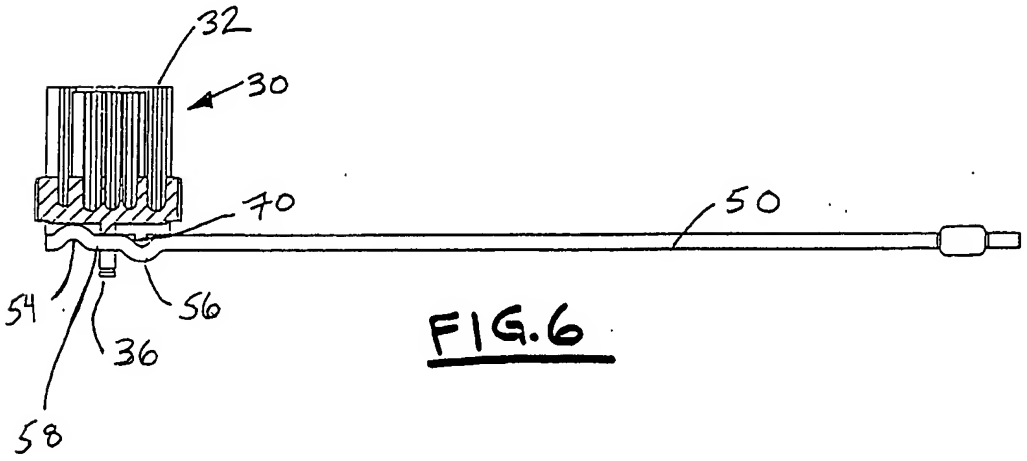

FIG.6

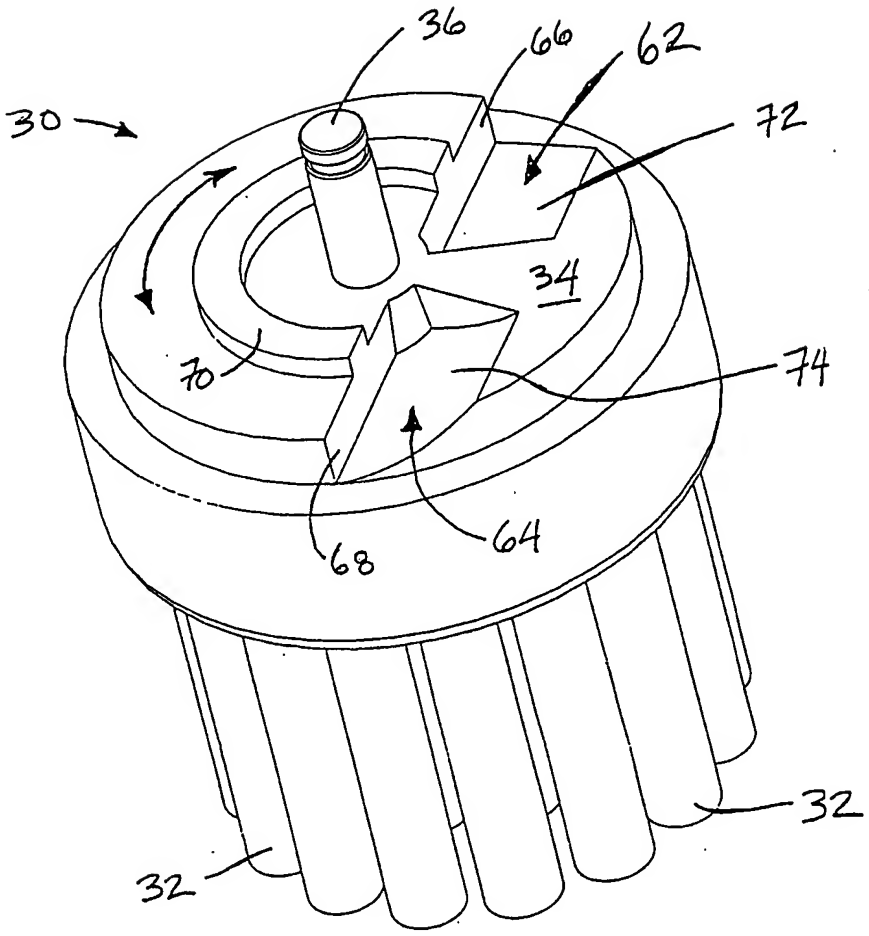

FIG. 7

INTERNATIONAL SEARCH REPORT

ıational Application No
PCT/CA 02/01329

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61C17/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 577 285 A (DROSSLER) 26 November 1996 (1996-11-26) figures 1-5 ---	1
Y	US 5 778 474 A (SHEK) 14 July 1998 (1998-07-14) figure 4 ---	1
A	US 5 625 916 A (MCDOUGALL) 6 May 1997 (1997-05-06) cited in the application figures ---	1
A	CH 688 537 A (TRISA BUERSTENFABRIK) 14 November 1997 (1997-11-14) the whole document ---	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 December 2002	12/12/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Raybould, B

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INTERNATIONAL SEARCH REPORT

ıational Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	WO 01 21094 A (GIMELLI) 29 March 2001 (2001-03-29) the whole document	1

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